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(54) PRODUCTION OF DEXTRIN

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for producing a dextrin with easiness for performance of filtration and deionization, in high yield and with economical advantages, as compared with conventional production methods.

SOLUTION: This method comprises addition of water to corn starch to make its slurry having a solid concentration of 5-30wt.%, adjustment, with addition of calcium hydroxide, of the slurry to pH 9.5-12.4 under homogenous mixing, heating at 95-150°C followed by neutralization, and finally, enzymatic liquefaction to obtain a low-viscosity dextrin liquid.

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(54) 【発明の名称】 デキストリンの製造方法

(57) 【要約】

【課題】 従来の製造方法に比較してろ過や脱イオンの操作の実施が容易であり、且つ歩留まりが高く、経済的に有利なデキストリンの製造方法を提供する。

【解決手段】 トウモロコシ澱粉に水を加えて固形分濃度5～30重量%のスラリーとし、均一に混合しながら水酸化カルシウムを加えてpH9.5～12.4に調節して温度95～150℃で加熱し、中和した後に、酵素液化し、粘度の低い液化液を得る。

【特許請求の範囲】

【請求項1】 デキストリンを製造するに際し、トウモロコシ澱粉に水を加えて固形分濃度5～30重量%のスラリーとし、均一に混合しながら水酸化カルシウムを加えてpH9.5～12.4に調節して温度95～150℃で加熱し、中和した後に、酵素液化工程を経由することを特徴とするデキストリンの製造方法。

【請求項2】 加熱を5～60分間実施し、酵素液化工程を基質固形分1gあたり1～20国際単位(IU)の耐熱液化酵素を用いて温度90～105℃でDE(デキストロース当量)1.5～15まで実施する請求項1記載のデキストリンの製造方法。

【請求項3】 デキストリンを製造するに際し、トウモロコシ澱粉に水を加えて固形分濃度5～25重量%のスラリーとし、均一に混合しながら水酸化カルシウムを加えてpH10～12に調節して温度105～135℃で5～60分間加熱し、中和した後に、耐熱液化酵素を加えて温度90～98℃でDE2～10まで液化し、pH4以下で酵素を失活させた後、脱色工程、脱イオン工程、濃縮工程を経由することを特徴とするデキストリンの製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】

【0002】本発明は、澱粉からデキストリンを製造する方法に関する。

【0003】

【従来の技術及び発明が解決しようとする課題】

【0004】デキストリンとは、一般に、澱粉を酸やアミラーゼ等で加水分解して得られる種々の重合度の分解生成物の混合物の総称であり、多くは特別な構造上の特徴を持たず、分子量も一定のものではない。

【0005】一般に、ヨウ素澱粉反応での呈色の程度によって、アミロデキストリン(青色)、エリトロデキストリン(赤色)、アクロデキストリン(呈色しない)、マルトデキストリン(呈色しない)などに区分される。

【0006】近年、これらのデキストリンの性質の中でも、低甘味、保水性、適度な粘性や、食品への弾力賦与、揚げ物等に用いた場合のサクサクした食感の賦与等に着眼して利用が増大している。

【0007】従来のデキストリンの製造方法としては、①特開昭48-67447号公報に紹介されているような、澱粉を固形分濃度10～30重量%程度にして酸又は酵素でDE(デキストロース当量、ブドウ糖の還元力を100としたときの試料の還元力の割合を表す。)5～15まで加水分解して液化液を調製し、これを活性炭での脱色、ろ過、イオン交換樹脂での脱イオンを経た後乾燥し、更に170～300℃で5分～3時間加熱処理してデキストリンを得る方法、②特公昭52-46290号公報に紹介されているような、澱粉にβ-アミラー

ゼを作用させて主としてマルトースとβ-リミットデキストリンからなる糖化液を生成させ、その糖化液をOH型アニオン交換樹脂でクロマト分離して、高純度のマルトースとβ-リミットデキストリンとを製造する方法、③特開昭61-205494号公報に紹介されているような、澱粉にα-アミラーゼをDE25程度になるまで作用させて分岐デキストリン類と直鎖オリゴ糖類からなる糖化液を生成させ、ついで得られる糖化液をゲル型のイオン交換樹脂に接触させることによって分岐デキストリン類と直鎖オリゴ糖類を選択分別する方法などがあった。

【0008】しかし、従来のデキストリンの製造方法には数多くの課題が残されていたのである。例えば、前記①の方法には、製造工程中の脱色後にろ過工程が必要であるが、最近のユーザーが望む低DEの製品を得ようとすると極端に粘度が高くなってしまい、経済的な濃度でのろ過が困難であった。また、脱イオンの際にイオン交換樹脂の表面に皮膜を形成する現象が発生し、極めて短時間のうちにイオン交換樹脂が脱イオン機能を失うという課題もあり、且つ、この方法で得られた製品は水に溶解したときに濃い黄色乃至茶色を呈するので用途が限定されるという課題もあった。

【0009】また、前記②や③の方法には、イオン交換樹脂により成分をデキストリン画分とオリゴ糖画分とにクロマト分離する際に極めて低い濃度での実施が要求されるので、その後の製品化の際に濃縮費用が高むという課題があり、また、クロマト分離の際に分離精度が高くないので分離しきれないデキストリン成分がオリゴ糖画分中に入り込んでしまいデキストリンの回収率が低いという課題もあったのである。

【0010】

【課題を解決するための手段】

【0011】前記課題を解決するため、本発明者等はデキストリンの製造方法を鋭意研究した結果、トウモロコシ澱粉のスラリーに水酸化カルシウムを加えてpH9.5～12.4に調節して加熱し、中和した後に、酵素液化工程を経由することにより、著しく短く簡便な方法で、食品工業用途に適した、種々の優れた性質を備えたデキストリンを調製することに成功し、本発明を完成するに至った。

【0012】第一の本発明は、デキストリンを製造するに際し、トウモロコシ澱粉に水を加えて固形分濃度5～30重量%のスラリーとし、均一に混合しながら水酸化カルシウムを加えてpH9.5～12.4に調節し、温度95～150℃で加熱し、中和した後に、酵素液化工程を経由することを特徴とするデキストリンの製造方法である。

【0013】第二の本発明は、加熱を5～60分間実施し、酵素液化工程を基質固形分1gあたり1～20単位の耐熱液化酵素を用いて温度90～105℃の範囲内で

DE（デキストロス当量）1.5～1.5まで実施する前記第一の発明に記載のデキストリンの製造方法である。

【0014】第三の本発明は、デキストリンを製造するに際し、トウモロコシ澱粉に水を加えて固形分濃度5～25重量%のスラリーとし、均一に混合しながら水酸化カルシウムを加えてpH10～12に調節し、温度105～135℃で5～60分間加熱し、中和した後に、耐熱液化酵素を加え、温度90～98℃でDE2～10まで液化し、pH4以下で酵素を失活させた後、脱色工程、脱イオン工程、濃縮工程を経由することを特徴とするデキストリンの製造方法である。

【0015】

【発明の実施の形態】

【0016】以下に本発明の内容を詳細に説明する。

【0017】本発明に用いる澱粉は、トウモロコシ由来の澱粉であれば有利に採用可能で、原料トウモロコシの産地や澱粉の製造方法に制約はなく、コーンスターチとして市販され、一般の澱粉糖製造用原料として用いられている程度のトウモロコシ澱粉の品質で十分である。

【0018】本発明をトウモロコシ以外の、例えば馬鈴薯やタピオカ由来の澱粉に適用した場合には、本発明中の水酸化カルシウムを加えてpHを9.5～12.4で加熱処理した後にデキストリンとその他の成分とが液中で明確に分離せず、ろ過工程の際に分離が困難になる場合があるので、それら由来の澱粉の使用は避けるべきである。

【0019】本発明を実施する際にはトウモロコシ澱粉に水を加えてスターチミルクと称されるスラリー状の混合物とするが、その際の固形分含量は5～30重量%が好ましく、5～25重量%の範囲が更に好ましい。

【0020】固形分濃度が5%未満の場合には、本発明の反応を実行することは可能であるが、設備の規模あたりの処理能力が小さくなることや後の工程で濃縮費用が嵩むことなどの経済的な理由から好ましくなく、30%を超える場合には加熱、攪拌中に粘度が極めて高くなり反応にむらができたり、本発明を実施するうえでの攪拌、移動、ろ過などの操作が極めて困難になるなどの理由からやはり好ましくない。

【0021】本発明に用いる水酸化カルシウムは、食品添加物として市販されているものの品質を備えているものであれば十分であり、その形態に制約は無く、液状、スラリー状、粉末状の何れも有利に採用することができる。

【0022】次に、前記で得られた該スラリーを均一に混合する方法としては一般に澱粉液化の際に用いられている生蒸気と該スラリーとを瞬時に混合して反応管内に滞留させるような、ジェットクッカーを用いた方法などが有利に採用可能であり、その方式も回分式、連続式の何れでもよい。

【0023】本発明の大きな特徴の一つは該澱粉スラリーのpHを9.5～12.4、更に好ましくは10～12の範囲内に調節して温度95～150℃、更に好ましくは105～130℃の範囲内で加熱することにあるが、この際のpHが9.5未満の場合には、反応が十分に進行せずに後述するような本発明の効果が十分に得られない場合があるので好ましくなく、一方、本発明では水酸化カルシウムを用いるので、pHが12.4を超える場合には他のpH調整剤が要求されることや副反応が起こることがあるなどの理由から好ましくない。

【0024】また、加熱温度は本発明の良好な効果を得るうえで95～150℃が好ましく、105～130℃が更に好ましいが、95℃未満の場合には反応が十分に進行せず、150℃を超える場合には焦げ付きや副反応が起こることがある。

【0025】本発明中の加熱後に中和する場合の中和剤は一般に澱粉糖化物を調製する際に用いられている酸が有利に採用できるが、中和後の工程を考慮すると先に用いたカルシウムを沈殿除去することが有利なので、カルシウムと結合して沈殿を生成するような酸、例えば磷酸、硫酸、磷酸などが最も有利である。

【0026】中和するときのpHの目安としては、この後の酵素液化の際に有利なpH範囲にすることが好ましいが、好ましいpHとしては例えば α -アミラーゼが安定で且つ活性の高い範囲、即ち、pH6.0～6.9、更に好ましくはpH6.5～6.8の範囲があげられる。

【0027】次に、本発明では酵素液化工程を経由することを必須要件としているが、この際に用いる液化酵素は、一般の澱粉液化工程の際に採用されている各種 α -アミラーゼが有利に採用可能であるが、それらの中でも高い温度で使用できる耐熱液化酵素が特に有利であり、銘柄の種類としては例えば、ノボ・インダストリー社製のターマミル（登録商標）などが挙げられる。

【0028】酵素の添加量は本発明を実現するうえで必要且つ十分な量であれば任意に採用できるが、発明者の経験の範囲からは、おおよそ澱粉固形分1グラムあたり1～20国際単位（IU）程度が適切である。

【0029】酵素反応の温度は、液化酵素が酵素活性を経済的に有利な程度に発揮出来る範囲が採用されるべきであるが、好ましい温度範囲としては、80～108℃、更に好ましくは耐熱液化酵素を用いる際に更に好適な90～105℃、最も好ましくは90～98℃が挙げられる。

【0030】また、本発明の効果を得るうえで酵素液化反応をDE1.5～1.5、更に好ましくは2～10の範囲まで実施するが、DE1.5未満の場合は反応を所望のDEに停止させること自体が極めて困難であり、且つ、得られる酵素液化液の粘度が高いため取扱いが困難なことが多く、DE1.5を超える場合には、マルトース

やグルコースなどの生成量が多くなり、甘味が強くなること、粘度が低くなりすぎることなどのデキストリンとして望まれない性質が強まるため好ましくない。

【0031】本発明の酵素液化反応の後に酵素を失活させる操作が必要であるが、その方法は一般に澱粉糖化業界で用いられている方法が有利に採用可能であり、例えば、塩酸、硫酸、燐酸、蔞酸などの酸を加えてpHを下げる方法、110℃程度に加熱して失活させる方法などが何れも採用できるが、これらの中でも一定の品質の製品を得るうえで、酸を加える方法が最も好ましい。

【0032】本発明の好ましい実施態様では脱色工程を経由するが、ブドウ糖や水飴などの一般的な糖化品に採用されている方法が本発明の際にも有利に適用可能であり、粒状活性炭または粉末状の活性炭を用いて回分式または連続式の方法で脱色することが最も好ましい。

【0033】粉末状の活性炭を採用する場合には脱色後にろ過工程を挿入する必要があるが、従来のデキストリンの製造方法に比べて本発明の場合はろ過工程の実施が極めて容易であり、このことは本発明を実施することにより得られる顕著な効果である。

【0034】また、ろ過工程を実施する際には、通常の糖化品の製造時に用いられる珪藻土などの適切なろ過助剤を用いてもよく、ろ布などのろ過材表面にプレコートしておいたり、活性炭と共に混合したり、前記の両方を行なうことも有利に採用することができる。

【0035】さらに、本発明の好ましい実施態様では、脱イオン工程を経由するが、この際にも一般の糖化品の製造に採用されているゼオライトや脱イオン用樹脂などのイオン交換材と回分式や連続式などの方法が本発明にも有利に採用することができる。

【0036】脱イオン工程の際に採用する樹脂の組み合わせの一例を挙げれば、強酸性陽イオン交換樹脂、強塩基性陰イオン交換樹脂、弱酸性陽イオン交換樹脂、中塩基性陰イオン交換樹脂、強酸性陽イオン交換樹脂と強塩基性陰イオン交換樹脂とのモノベッドの順にイオン交換樹脂塔を通すことも有利な脱イオン法である。

【0037】この脱イオン工程の際にも、従来のデキストリンの製造方法に比べて本発明の場合は液の粘度が著しく低いことや脱イオン材の表面に粘質膜を形成せず脱イオン材の寿命を短縮しないことなどから、実施が極めて容易であり、このことも本発明を実施することにより得られる顕著な効果である。

【0038】前記の脱色、脱イオン工程で精製されたデキストリン水溶液は、本発明の好ましい実施態様では濃縮工程を経由するが、その方法については、例えば、一般に澱粉糖化製品の製造に採用されているような薄膜流下式などの比較的粘度の高い物質を濃縮する際に適切な方法であれば採用可能であり、液状の製品として流通させる場合の適切な濃度は製品のDEによって異なり、需要家の要望に沿った程度まで濃縮すればよいが、粉末品

を得ようとした場合には、濃度30～65%程度にするとう都合が良い。

【0039】また、濃縮した後、必要に応じて、例えば噴霧乾燥法等のそれ自体は公知の方法により粉末または顆粒を調製することも自由である。

【0040】以上に説明した本発明を実施することにより、従来の方法よりも、極めて容易にろ過や脱イオンなどの工程を実行することが可能になり、且つ優れた性質を有するデキストリンを得ることができる。

10 【0041】

【実施例】

【0042】以下に実施例を掲げて本発明の内容を更に具体的に説明するが、本発明の技術的範囲は、以下の例によって制限されるものではない。

【0043】尚、各例中、%は、特に断らない限り全て重量%を表すものとする。

【0044】

【実施例-1】

20 【0045】容積10リットルの攪拌機付き耐圧液化試験装置中に市販の澱粉〔日本食品化工(株)製、コーンスターチ〕150gを入れ、水850gを加えて混合したのち攪拌しながら試薬の水酸化カルシウムを加えてpH10.5とし、生蒸気を吹き込んで温度125℃で15分間加熱した。

【0046】次に、耐圧容器の蓋を解放し、攪拌しながら蔞酸を加えてpH6.5とし、温度95℃に調節しながら市販の耐熱液化酵素〔ノボ・インダストリー社製、ターマミル(登録商標)〕750IUを添加してDE5まで液化し、pH3.9になるまで蔞酸を加えて酵素を失活させ、市販の粉末活性炭1gを加えて温度50℃で20分間攪拌脱色し、更に市販の珪藻土ろ過助剤〔昭和化学株式会社製、商品名ラジオライト(登録商標)〕1gを加えてろ過し、ろ液を得た。

30 【0047】更に、該ろ液をイオン交換樹脂で脱イオンし、回転式薄膜式濃縮装置(東京理化学器械株式会社製、ロータリーエバポレーター、N-1N型)で濃度30%まで濃縮し、無色で澄明なデキストリン水溶液480gを得た。(固形分の収率は原料の澱粉を100としたとき96%である。)

40 【0048】実施例-1で得られたデキストリン水溶液の性質を以下に説明する。

【0049】〔粘度(濃度)〕温度40℃で測定した結果、実施例-1で得られたデキストリン水溶液の粘度は、濃度10%では4cp、20%では6cp、30%では12cp、40%では40cpであった。

【0050】〔よう素反応〕実施例-1で得られたデキストリン水溶液をよう素澱粉反応に供した結果、淡い橙色であった。この結果から、本発明の操作により高分子量の成分は殆ど残っていないことが判る。

50 【0051】〔老化の試験〕実施例-1で得られた濃度

30%のデキストリン水溶液を温度4℃で貯蔵し、該水溶液の光の透過率を測定した結果99.2%であり、5日目毎に、30日目まで測定した結果、光透過率は低下せず、99.2%であった。この結果から、本発明により得られたデキストリンは保存期間中に極めて老化しにくいという優れた性質を備えていることが判る。

【0052】〔糖組成(ブドウ糖単位をGで示す)〕G1が0.5%、G2が4.5%、G3が8.1%、G4以上が86.9%であった。

【0053】

【実施例-2】

【0054】澱粉の量を70g、水の量を930gとし、水酸化カルシウムを加えた後のpHを10.9とし、温度110℃で20分間とした他は実施例-1と同様に加熱した。

【0055】次に実施例-1と同様に中和し、酵素量を澱粉1gあたり10IUとし、温度94℃とした他は実施例-1と同様にDE=3まで酵素液化し、酵素失活、脱色、脱イオン、濃縮を行なってデキストリン水溶液を得た。

【0056】操作の中で、脱色後のろ過は容易であり、脱イオンの際にも操作が容易であり、何ら操作上の困難はなかった。

【0057】

【実施例-3】

【0058】澱粉の量を200g、水の量を800gとし、水酸化カルシウムを加えた後のpHを10.8とし、温度130℃で20分間とした他は実施例-1と同様に加熱した。

【0059】次に実施例-1と同様に中和し、酵素量を澱粉1gあたり15IUとし、温度95℃とした他は実施例-1と同様にDE=11まで酵素液化し、酵素失活、脱色、脱イオン、濃縮を行なってデキストリン水溶液を得た。

【0060】工程中のろ過工程、脱イオン工程共に通常の糖化品の処理と同様に操作することが可能であり、通常のデキストリン製造時のような高い粘度や粘質物による操作上の困難はなかった。

【0061】実施例-3で得られたデキストリン水溶液の性質を以下に説明する。

【0062】〔粘度(濃度)〕温度40℃で測定した結果、実施例-3で得られたデキストリン水溶液の粘度は、濃度10%では3.5cp、20%では5cp、30%では10cp、40%では30cpであった。

【0063】〔よう素反応〕実施例-3で得られたデキストリン水溶液をよう素澱粉反応に供した結果、淡い橙色であった。この結果から、本発明の操作により大分子量の成分は殆ど残っていないことが判る。

【0064】〔老化の試験〕実施例-3で得られた濃度30%のデキストリン水溶液を温度4℃で貯蔵し、該水

溶液の光の透過率を測定した結果99.1%であり、5日目毎に、30日目まで測定した結果、光透過率は低下せず、99.0%であった。この結果から、本発明により得られたデキストリンは保存期間中に極めて老化しにくいという優れた性質を備えていることが判る。

【0065】〔糖組成(ブドウ糖単位をGで示す)〕G1が1.5%、G2が8.3%、G3が10.3%、G4以上が79.9%であった。

【0066】

10 【実施例-4】

【0067】水酸化カルシウムを加えた後のpHを10.3とし、温度130℃で20分間とした他は全て実施例-1と同様にデキストリン水溶液を得た。

【0068】工程中のろ過工程、脱イオン工程共に通常の糖化品の処理と同様に操作することが可能であり、通常のデキストリン製造時のような高い粘度や粘質物による操作上の困難はなかった。

20 【0069】得られたデキストリン水溶液を減圧下で更に濃縮し、乾燥した結果、白色粉末状のデキストリンを得た。

【0070】得られた粉末は甘味が殆ど無く、澱粉臭が無く、冷水に易溶で、溶解したときは無色澄明な水溶液となった。

【0071】

【比較例-1】

【0072】澱粉の量を320g、水の量を680gとした他は実施例-1と同様に水酸化カルシウムを添加して加熱したところ、粘度が極めて高いため混合不可能で攪拌しながらの加熱処理ができなかった。

30 【0073】

【比較例-2】

【0074】水酸化カルシウムを加えた後のpHを8.5とした他は実施例-1と同様に加熱処理し、中和した後、実施例-1と同様に酵素液化し、酵素を失活させて脱色工程を行なったところ、ろ過装置粘質物が付着してろ過することができなかった。

【0075】

【比較例-3】

40 【0076】水酸化カルシウムを加えた後の加熱温度を90℃とした他は実施例-1と同様に加熱処理し、中和した後、実施例-1と同様に酵素液化し、酵素を失活させて脱色工程を行なったところ、ろ過装置粘質物が付着してろ過することができなかった。

【0077】

【比較例-4】

【0078】市販の澱粉〔日本食品化工(株)製、コーンスターチ〕150gと水850gを混合して固形分濃度15%とし、pH6.2に調整後、基質1gあたり10IUの耐熱液化酵素〔ノボ・インダストリー社製、ターマミル(登録商標)〕を用い、温度105℃で約3分間加

熱し、次に液を 65℃ に冷却し、更に該耐熱液化酵素 10IU を添加して 30 分間保持した後、蔞酸を加えて pH3.8 とし、DE15 のデキストリンを得た。

【0079】比較例 4 で得られた濃度 30% のデキストリン水溶液を温度 4℃ で貯蔵し、該水溶液の光の透過率を測定した結果製造直後約 98.4% であったが、5 日目毎に、30 日目まで測定した結果、第 1 日目には既に白い濁りが発生し、時間とともに光透過率は低下し続け、25 日目には透過率が約 15% となった。

【0080】

【発明の効果】

【0081】本発明を実施することにより得られる酵素液化液が低粘度でありデキストリン以外の成分が極めて分離しやすい形態で液中に残るので、従来のデキストリンの製造方法に比べ、ろ過、脱イオン等の製造操作の実施が極めて容易になり、また、酵素反応を過剰に実施した後に分画してデキストリンを得る方法に比べて原料あたりの製品回収率が格段に高く、経済的に有利なので、実施の容易な且つ経済的に有利なデキストリンの製造方法が提供される。

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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the dextrin which it faces manufacturing a dextrin, water is added to amylum maydis, and it considers as the slurry of 5 - 30 % of the weight of solid content concentration, adds a calcium hydroxide, adjusts to pH 9.5-12.4, heats at the temperature of 95-150 degrees C, mixing to homogeneity, and is characterized by going via an enzyme liquefaction process after neutralizing.

[Claim 2] The manufacture approach of a dextrin according to claim 1 of heating for 5 - 60 minutes and carrying out an enzyme liquefaction process to DE (dextrose equivalent) 1.5-15 at the temperature of 90-105 degrees C using the heat-resistant hankyu liquifase of one to 20 international unit (IU) per 1g of substrate solid content.

[Claim 3] Face manufacturing a dextrin, add water to amylum maydis, and it considers as the slurry of 5 - 25 % of the weight of solid content concentration. Mixing to homogeneity, add a calcium hydroxide, adjust to pH 10-12, and it heats for 5 - 60 minutes at the temperature of 105-135 degrees C. The manufacture approach of the dextrin characterized by going via a decolorization process, a deionization process, and a concentration process after adding heat-resistant hankyu liquifase, liquefying to DE 2-10 at the temperature of 90-98 degrees C after neutralizing, and carrying out deactivation of the enzyme by four or less pH.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

[0002] This invention relates to the approach of manufacturing a dextrin from starch.

[0003]

[Description of the Prior Art]

[0004] Generally, a dextrin is the generic name of the mixture of the decomposition product of the various polymerization degree acquired by hydrolyzing starch by the acid, an amylase, etc., many do not have the description on special structure and its molecular weight is not fixed, either.

[0005] Generally, it is classified into amylopectin (blue), erythropectin (red), achropectin (coloration is not carried out), a maltopectin (coloration is not carried out), etc. with extent of the coloration in an iodine starch reaction.

[0006] In recent years, paying attention to the endowment of mouthfeel snappily carried out at the time of using for low sweet taste, water retention, moderate viscosity, elasticity endowment for food, deep-fried dishes, etc., use is increasing also in the property of these dextrins.

[0007] As [introduce / to ** JP,48-67447,A / as the manufacture approach of the conventional dextrin] Starch is made into about 10 - 30 % of the weight of solid content concentration, and it is DE (the rate of the reducing power of the sample when setting reducing power of a dextrose equivalent and grape sugar to 100 is expressed.) with an acid or an enzyme. It hydrolyzes to 5-15 and liquefaction liquid is prepared. This Decolorization with activated carbon, How to dry after passing through the deionization in filtration and ion exchange resin, to heat-treat at further 170-300 degrees C for 5 minutes to 3 hours, and to obtain a dextrin, ** Make liquid generate. the saccharification which the beta-amylase is made to act on starch which is introduced to JP,52-46290,B, and mainly consists of a maltose and beta-limit dextrin -- the saccharification -- the approach of carrying out chromatography separation of the liquid with OH mold anion exchange resin, and manufacturing the maltose and beta-limit dextrin of a high grade -- ** Make liquid generate. the saccharification which alpha-amylase is made to act on it until it becomes starch which is introduced to JP,61-205494,A at about 25 DE, and consists of branching dextrins and straight chain oligosaccharide -- subsequently, the saccharification acquired -- there was the approach of carrying out selection judgment of branching dextrins and the straight chain oligosaccharide etc. by contacting liquid on the ion-exchange resin of a gel mold.

[0008] However, many technical problems were left behind to the manufacture approach of the conventional dextrin. For example, although the filtration process was required after the decolorization in a production process, when it was going to obtain the product of low DE which the latest user desires, viscosity became high extremely, and filtration by economical concentration was difficult for the approach of the aforementioned **. Moreover, since the product which the phenomenon which forms a coat on the surface of ion exchange resin in the case of deionization occurs, and the technical problem that ion exchange resin loses a deionization function in the inside of a short time extremely also has, and was obtained by this approach presented deep yellow thru/or brown when it dissolved in water, it also

had the technical problem that an application was limited.

[0009] Moreover, the dextrin component which the technical problem that concentration costs increase occurs in the case of subsequent commercial production since operation by very low concentration is required of the approach of the aforementioned ** or ** in case chromatography separation of the component is carried out with ion-exchange resin at a dextrin fraction and an oligosaccharide fraction, and cannot be separated since the sharpness of separation is not high in case it is chromatography separation entered into the oligosaccharide fraction, and the technical problem that the recovery of a dextrin was low also had it.

[0010]

[Means for Solving the Problem]

[0011] The result to which this invention person etc. studied the manufacture approach of a dextrin wholeheartedly in order to solve said technical problem, After adjusting, heating and neutralizing to pH 9.5-12.4, by adding a calcium hydroxide to the slurry of amylum maydis, and going via an enzyme liquefaction process by the remarkable short simple approach It succeeds in preparing the dextrin equipped with the property suitable for a food-stuff-industry application which was excellent in versatility, and came to complete this invention.

[0012] The first this invention is faced manufacturing a dextrin, adds water to amylum maydis, makes it the slurry of 5 - 30 % of the weight of solid content concentration, adds a calcium hydroxide, adjusts it to pH 9.5-12.4, mixing to homogeneity, is heated at the temperature of 95-150 degrees C, and after neutralizing, it is the manufacture approach of the dextrin characterized by going via an enzyme liquefaction process.

[0013] The second this invention is the manufacture approach of a dextrin given in said first invention which heats for 5 - 60 minutes and carries out an enzyme liquefaction process to DE (dextrose equivalent) 1.5-15 by within the limits with a temperature of 90-105 degrees C using the heat-resistant hankyu liquifase of one to 20 unit per 1g of substrate solid content.

[0014] Face the third this invention manufacturing a dextrin, it adds water to amylum maydis, and makes it the slurry of 5 - 25 % of the weight of solid content concentration. Mixing to homogeneity, add a calcium hydroxide and it adjusts to pH 10-12. After adding heat-resistant hankyu liquifase, liquefying to DE 2-10 at the temperature of 90-98 degrees C, after heating for 5 - 60 minutes and neutralizing at the temperature of 105-135 degrees C, and carrying out deactivation of the enzyme by four or less pH, it is the manufacture approach of the dextrin characterized by going via a decolorization process, a deionization process, and a concentration process.

[0015]

[Embodiment of the Invention]

[0016] The contents of this invention are explained below at a detail.

[0017] The quality of the amylum maydis of extent which can adopt it advantageously if the starch used for this invention is starch of the corn origin, and constraint does not have in the manufacture approach of the place of production of raw material corn or starch, is marketed as corn starch, and is used as a common raw material for starch sugar manufacture is enough.

[0018] Since a dextrin and other components may not dissociate clearly in liquid but separation may become difficult in the case of a filtration process after adding the calcium hydroxide in this invention and heat-treating pH by 9.5-12.4 when this invention is applied to starch of the tapioca origin other than corn (for example, a potato), use of the starch of these origins should be avoided.

[0019] Although it considers as the slurry-like mixture which adds water to amylum maydis and is called starch milk in case this invention is carried out, the solid content content in that case has 5 - 30 desirable % of the weight, and 5 - 25% of the weight of its range is still more desirable.

[0020] Although it is possible to perform the reaction of this invention when solid content concentration is less than 5% Are not desirable from the economical reasons of concentration costs increasing at that the throughput per scale of a facility becomes small, or a next process. When exceeding 30%, it is not desirable too from the reasons of actuation of heating, churning when viscosity becomes very high during churning, unevenness is made to a reaction or this invention is carried out for it, migration,

filtration, etc. becoming very difficult.

[0021] Although the calcium hydroxide used for this invention is marketed as a food additive, if it has quality, it is enough, and there is no constraint in the gestalt and it can adopt advantageously all of the shape of the shape of a liquid and a slurry, and powder as it.

[0022] Next, the approach using a jet cooker which mixes the live steam and this slurry which are generally used as an approach of mixing to homogeneity this slurry obtained above in the case of starch liquefaction in an instant, and is made to pile up within a reaction etc. can adopt advantageously, and any of a batch process and continuous system are sufficient also as the method.

[0023] Although one of the big descriptions of this invention is to adjust within the limits of 10-12 still more preferably, and heat [9.5-12.4, and] within the limits of 105-130 degrees C still more preferably the temperature of 95-150 degrees C, pH of this starch slurry Since the effectiveness of this invention which is mentioned later, without a reaction fully advancing may not fully be acquired and a calcium hydroxide is preferably used by this invention on the other hand when pH in this case is less than 9.5 When pH exceeds 12.4, it is not desirable from the reasons of other pH regulators' being required and side reaction occurring.

[0024] Moreover, although whenever [stoving temperature] has desirable 95-150 degrees C when acquiring the good effectiveness of this invention, and 105-130 degrees C is still more desirable, when a reaction does not fully advance in the case of less than 95 degrees C but it exceeds 150 degrees C, bad debt and side reaction may occur.

[0025] Although the acid used in case a starch sugar ghost is generally prepared can adopt advantageously the neutralizer in the case of neutralizing after heating in this invention, since it is advantageous to carry out precipitate removal of the calcium used previously when the process after neutralization is taken into consideration, an acid which combines with calcium and generates precipitate, for example, oxalic acid, a sulfuric acid, phosphoric acid, etc. are the most advantageous.

[0026] although it is desirable to make it advantageous pH range in the case of next enzyme liquefaction as a standard of pH when neutralizing -- the range 6.0-6.9 where alpha-amylase is stable as desirable pH and where activity is high, i.e., pH, -- the range of pH 6.5-6.8 is raised still more preferably.

[0027] Next, although the various alpha-amylases adopted in the case of a general starch liquefaction process can adopt advantageously the hankyu liquifase used in this case although it is making to go via an enzyme liquefaction process into indispensable requirements in this invention, especially the heat-resistant hankyu liquifase that can be used at temperature high also in them is advantageous, and Termamyl (trademark) for example, by the Novo industry company etc. is mentioned as a class of brand.

[0028] Although the additions of an enzyme are employable as arbitration if they are the need and sufficient amount when realizing this invention, from the range of experience of an artificer, one to 20 international-unit (IU) extent is about suitable per 1g of starch solid content.

[0029] although the range where hankyu liquifase can demonstrate enzyme activity to advantageous extent economically should be adopted, in case heat-resistant hankyu liquifase is used for the temperature of an enzyme reaction still more preferably, it is still more suitable 80-108 degrees C as a desirable temperature requirement -- 90-105-degree C 90-98 degrees C are mentioned most preferably.

[0030] when [moreover,] acquiring the effectiveness of this invention -- an enzyme liquefaction reaction -- DE 1.5-15, although carried out to the range of 2-10 still more preferably In the case of less than 1.5 DE, it is very difficult to make desired DE suspend a reaction itself. and since the viscosity of the enzyme liquefaction liquid obtained is high, when it is common for handling to be difficult and it exceeds DE15 Since the property which is not desired as dextrins, like that the amounts of generation, such as a maltose and a glucose, increase and sweet taste becomes strong and viscosity becomes low too much becomes strong, it is not desirable.

[0031] Although the actuation to which deactivation of the enzyme is carried out is required after the enzyme liquefaction reaction of this invention Although each of approaches of the approach generally used in the starch sugar-ized industry being able to adopt the approach advantageously, for example, adding acids, such as a hydrochloric acid, a sulfuric acid, phosphoric acid, and oxalic acid, and lowering

pH, approaches of heating and carrying out deactivation to about 110 degrees C, etc. can adopt When obtaining the product of fixed quality also in these, the method of adding an acid is the most desirable. [0032] although it goes via a decolorization process in the desirable embodiment of this invention -- general saccharification of grape sugar, a starch syrup, etc. -- it is most desirable to be able to apply advantageously, also in case the approach adopted as elegance is this invention, and to decolorize by the approach of a batch process or continuous system using granular active carbon or powder-like activated carbon.

[0033] Although it is necessary to insert a filtration process after decolorization to adopt powder-like activated carbon, in the case of this invention, compared with the manufacture approach of the conventional dextrin, operation of a filtration process is very easy, and this is remarkable effectiveness acquired by carrying out this invention.

[0034] moreover, the usual saccharification in case a filtration process is carried out -- suitable filter aid, such as diatomaceous earth used at the time of manufacture of elegance, may be used, precoat can be carried out to filter-medium front faces, such as a filter cloth, it can mix on them with activated carbon, or performing above both can also be advantageously adopted as them.

[0035] furthermore -- although it goes via a deionization process in the desirable embodiment of this invention -- saccharification general also in this case -- approaches, such as the ion-exchange material and batch processes which are adopted as manufacture of elegance, such as a zeolite and resin for deionization, and continuous system, can adopt in favor also of this invention.

[0036] if an example of the combination of the resin adopted in the case of a deionization process is given -- the order of the monobed of strongly acidic cation exchange resin, strongly basic anion exchange resin, weakly acidic cation exchange resin, the Nakashio machine nature anion exchange resin, strongly acidic cation exchange resin, and strongly basic anion exchange resin -- ion exchange resin -- it is also an advantageous deionization method to let a column pass.

[0037] Since the mucus film is not formed in the front face of that the viscosity of liquid is remarkably low, or deionization material in the case of this invention and the life of deionization material is not shortened compared with the manufacture approach of the conventional dextrin in the case of this deionization process, operation is very easy and it is the remarkable effectiveness acquired when this also carries out this invention.

[0038] Although the dextrin water solution refined at the aforementioned decolorization and a deionization process goes via a concentration process in the desirable embodiment of this invention If it is a suitable approach in case matter with comparatively high viscosity, such as a thin film flowing-down type which is generally adopted as manufacture of a starch sugar-ized product about the approach, for example, is condensed, are employable. Although what is necessary is just to condense to extent which the suitable concentration in the case of making it circulate as a liquefied product changed with DE of a product, and met the request of a consumer, it is convenient when it is going to obtain a powder article, and it is made about 30 - 65% of concentration.

[0039] Moreover, after condensing, it is also free to prepare powder or granulation by the well-known approach in itself [, such as a spray drying method] if needed.

[0040] By carrying out this invention explained above, rather than the conventional approach, it becomes possible to perform processes, such as filtration and deionization, very easily, and the dextrin which has the outstanding property can be obtained.

[0041]

[Example]

[0042] Although an example is hung up over below and the contents of this invention are explained to it still more concretely, the technical range of this invention is not restricted by the following examples.

[0043] In addition, among each example, especially % shall express weight % altogether, unless it refuses.

[0044]

[Example -1]

[0045] Starch [Japan Maize Products Co., Ltd. make and corn-starch] 150g of marketing was put in into

the proof-pressure liquefaction testing device with an agitator with a volume of 10l., and the calcium hydroxide of a reagent was added, it was referred to as pH10.5, agitating, after adding 850g of water and mixing, live steam was blown, and it heated for 15 minutes at the temperature of 125 degrees C. [0046] Next, releasing and agitating the lid of a proof-pressure container, add oxalic acid and it is referred to as pH6.5. Adjusting in temperature of 95 degrees C Commercial heat-resistant hankyu liquifase [Novo industry company make, Add Termamyl (trademark)]750IU and it liquefies to DE5. Oxalic acid is added, deactivation of the enzyme was carried out, 1g of commercial powdered activated carbon was added, churning decolorization was carried out for 20 minutes at the temperature of 50 degrees C, diatomaceous earth filter aid [Showa chemistry incorporated company make and trade name radio light (trademark)] 1g of marketing was further added and filtered until it was set to pH3.9, and the filtrate was obtained.

[0047] Furthermore, deionization of this filtrate was carried out with ion exchange resin, it condensed to 30% of concentration with rotating type thin film type concentration equipment (the Tokyo Rikakikai Co., Ltd. make, a rotary evaporator, N-1 N type), and 480g of clear dextrin water solutions was obtained by colorlessness. (The yield of solid content is 96% when the starch of a raw material is set to 100.)

[0048] The property of the dextrin water solution obtained in the example -1 is explained below.

[0049] As a result of measuring at [viscosity (concentration)] temperature of 40 degrees C, the viscosity of the dextrin water solution obtained in the example -1 was 40cp by 6cp and 30% at 4cp and 20% in 10% of concentration at 12cp and 40%.

[0050] It was light orange as a result of presenting an iodine starch reaction with the dextrin water solution obtained in the [iodine reaction] example -1. This result shows that most components of large molecular weight do not remain by actuation of this invention.

[0051] As a result of storing the dextrin water solution of 30% of concentration obtained in the [trial of aging] example -1 at the temperature of 4 degrees C and measuring the permeability of the light of this water solution, it was 99.2%, and as a result of measuring till the 30th every 5th day, light transmittance did not fall but was 99.2%. This result shows having the outstanding property in which the dextrin obtained by this invention cannot age very easily during a retention period.

[0052] [Sugar composition (G shows a grape-sugar unit)] For G2, G3 was [G1 / four or more / 8.1% G] 86.9% 4.5% 0.5%.

[0053]

[Example -2]

[0054] Set the amount of 70g and water to 930g for the amount of starch, set pH after adding a calcium hydroxide to 10.9, and it considered as for 20 minutes at the temperature of 110 degrees C, and also heated like the example -1.

[0055] Next, neutralized like the example -1, set the amount of enzymes to 10IU per 1g of starch, and it considered as the temperature of 94 degrees C, and also enzyme liquefaction was carried out to DE=3 like the example -1, enzyme deactivation, decolorization, deionization, and concentration were performed, and the dextrin water solution was obtained.

[0056] In actuation, the filtration after decolorization is easy, actuation is easy also in the case of deionization, and there was no difficulty on actuation in any way.

[0057]

[Example -3]

[0058] Set the amount of 200g and water to 800g for the amount of starch, set pH after adding a calcium hydroxide to 10.8, and it considered as for 20 minutes at the temperature of 130 degrees C, and also heated like the example -1.

[0059] Next, neutralized like the example -1, set the amount of enzymes to 15IU per 1g of starch, and it considered as the temperature of 95 degrees C, and also enzyme liquefaction was carried out to DE=11 like the example -1, enzyme deactivation, decolorization, deionization, and concentration were performed, and the dextrin water solution was obtained.

[0060] saccharification usual in a filtration process in process and a deionization process -- it is possible to operate it like processing of elegance, and there was no difficulty on actuation by the high viscosity

and the high mucilage like [at the time of the usual dextrin manufacture].

[0061] The property of the dextrin water solution obtained in the example -3 is explained below.

[0062] As a result of measuring at [viscosity (concentration)] temperature of 40 degrees C, the viscosity of the dextrin water solution obtained in the example -3 was 30cp by 5cp and 30% at 3.5cp and 20% in 10% of concentration at 10cp and 40%.

[0063] It was light orange as a result of presenting an iodine starch reaction with the dextrin water solution obtained in the [iodine reaction] example -3. This result shows that most components of large molecular weight do not remain by actuation of this invention.

[0064] As a result of storing the dextrin water solution of 30% of concentration obtained in the [trial of aging] example -3 at the temperature of 4 degrees C and measuring the permeability of the light of this water solution, it was 99.1%, and as a result of measuring till the 30th every 5th day, light transmittance did not fall but was 99.0%. This result shows having the outstanding property in which the dextrin obtained by this invention cannot age very easily during a retention period.

[0065] [Sugar composition (G shows a grape-sugar unit)] For G2, G3 was [G1 / four or more / 10.3% G] 79.9% 8.3% 1.5%.

[0066]

[Example -4]

[0067] Set pH after adding a calcium hydroxide to 10.3, and it considered as for 20 minutes at the temperature of 130 degrees C, and also [all] the dextrin water solution was obtained like the example -1.

[0068] saccharification usual in a filtration process in process and a deionization process -- it is possible to operate it like processing of elegance, and there was no difficulty on actuation by the high viscosity and the high mucilage like [at the time of the usual dextrin manufacture].

[0069] The obtained dextrin water solution was further condensed under reduced pressure, and as a result of drying, the white powder-like dextrin was obtained.

[0070] the time of the obtained powder having not almost had sweet taste and there having been no starch smell, and it being easily dissolvable in cold water, and dissolving in it -- colorlessness -- it became a clear water solution.

[0071]

[The example -1 of a comparison]

[0072] Heat-treatment when the amount of 320g and water was set to 680g and also a calcium hydroxide is added and heated like an example -1, while it cannot mix since viscosity is very high and agitates was not able to do the amount of starch.

[0073]

[The example -2 of a comparison]

[0074] After having set pH after adding a calcium hydroxide to 8.5, and also heat-treating like the example -1 and neutralizing, when enzyme liquefaction was carried out like the example -1, deactivation of the enzyme was carried out and the decolorization process was performed, the filter mucilage adhered and it was not able to filter.

[0075]

[The example -3 of a comparison]

[0076] After having made whenever [stoving temperature / after adding a calcium hydroxide] into 90 degrees C, and also heat-treating like the example -1 and neutralizing, when enzyme liquefaction was carried out like the example -1, deactivation of the enzyme was carried out and the decolorization process was performed, the filter mucilage adhered and it was not able to filter.

[0077]

[The example -4 of a comparison]

[0078] Mix commercial starch [Japan Maize Products Co., Ltd. make and corn-starch] 150g and 850 commercial of water, and it considers as 15% of solid content concentration. Per 1g of substrates, after adjusting to pH6.2 The heat-resistant hankyu liquifase [Novo industry company make of 10IU, After having heated for about 3 minutes at the temperature of 105 degrees C, then having cooled liquid at 65

degrees C using Termamyl (trademark)], adding this heat-resistant hankyu liquifase 10IU further and holding for 30 minutes, oxalic acid was added, it was referred to as pH3.8, and the dextrin of DE15 was obtained.

[0079] As a result of storing the dextrin water solution of 30% of concentration obtained in the example -4 of a comparison at the temperature of 4 degrees C and measuring the permeability of the light of this water solution, although it was immediately after manufacture about 98.4%, white muddiness already occurred at the 1st day, as a result of measuring till the 30th every 5th day, with time amount, light transmittance continued falling and permeability became about 15% on the 25th.

[0080]

[Effect of the Invention]

[0081] Since it remains into liquid with the gestalt which the enzyme liquefaction liquid obtained by carrying out this invention is hypoviscosity, and components other than a dextrin tend [very] to separate Compared with the manufacture approach of the conventional dextrin, implementation of manufacture actuation, such as filtration and deionization, becomes very easy. moreover -- since the product recovery per raw material is alike and high compared with the approach of carrying out fractionation and obtaining a dextrin and it is economically advantageous, after carrying out an enzyme reaction superfluously -- easy **** of operation -- the manufacture approach of an advantageous dextrin is offered economically.

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TECHNICAL FIELD

[Field of the Invention]

[0002] This invention relates to the approach of manufacturing a dextrin from starch.

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EFFECT OF THE INVENTION

[Effect of the Invention]

[0081] Since it remains into liquid with the gestalt which the enzyme liquefaction liquid obtained by carrying out this invention is hypoviscosity, and components other than a dextrin tend [very] to separate Compared with the manufacture approach of the conventional dextrin, implementation of manufacture actuation, such as filtration and deionization, becomes very easy. moreover -- since the product recovery per raw material is alike and high compared with the approach of carrying out fractionation and obtaining a dextrin and it is economically advantageous, after carrying out an enzyme reaction superfluously -- easy **** of operation -- the manufacture approach of an advantageous dextrin is offered economically.

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TECHNICAL PROBLEM

[Description of the Prior Art]

[0004] Generally, a dextrin is the generic name of the mixture of the decomposition product of the various polymerization degree acquired by hydrolyzing starch by the acid, an amylase, etc., many do not have the description on special structure and its molecular weight is not fixed, either.

[0005] Generally, it is classified into amylopectin (blue), erythropectin (red), achropectin (coloration is not carried out), a maltopectin (coloration is not carried out), etc. with extent of the coloration in an iodine starch reaction.

[0006] In recent years, paying attention to the endowment of mouthfeel snappily carried out at the time of using for low sweet taste, water retention, moderate viscosity, elasticity endowment for food, deep-fried dishes, etc., use is increasing also in the property of these dextrins.

[0007] As [introduce / to ** JP,48-67447,A / as the manufacture approach of the conventional dextrin] Starch is made into about 10 - 30 % of the weight of solid content concentration, and it is DE (the rate of the reducing power of the sample when setting reducing power of a dextrose equivalent and grape sugar to 100 is expressed.) with an acid or an enzyme. It hydrolyzes to 5-15 and liquefaction liquid is prepared. This Decolorization with activated carbon, How to dry after passing through the deionization in filtration and ion exchange resin, to heat-treat at further 170-300 degrees C for 5 minutes to 3 hours, and to obtain a dextrin, ** Make liquid generate. the saccharification which the beta-amylase is made to act on starch which is introduced to JP,52-46290,B, and mainly consists of a maltose and beta-limit dextrin -- the saccharification -- the approach of carrying out chromatography separation of the liquid with OH mold anion exchange resin, and manufacturing the maltose and beta-limit dextrin of a high grade -- ** Make liquid generate. the saccharification which alpha-amylase is made to act on it until it becomes starch which is introduced to JP,61-205494,A at about 25 DE, and consists of branching dextrins and straight chain oligosaccharide -- subsequently, the saccharification acquired -- there was the approach of carrying out selection judgment of branching dextrins and the straight chain oligosaccharide etc. by contacting liquid on the ion-exchange resin of a gel mold.

[0008] However, many technical problems were left behind to the manufacture approach of the conventional dextrin. For example, although the filtration process was required after the decolorization in a production process, when it was going to obtain the product of low DE which the latest user desires, viscosity became high extremely, and filtration by economical concentration was difficult for the approach of the aforementioned **. Moreover, since the product which the phenomenon which forms a coat on the surface of ion exchange resin in the case of deionization occurs, and the technical problem that ion exchange resin loses a deionization function in the inside of a short time extremely also has, and was obtained by this approach presented deep yellow thru/or brown when it dissolved in water, it also had the technical problem that an application was limited.

[0009] Moreover, the dextrin component which the technical problem that concentration costs increase occurs in the case of subsequent commercial production since operation by very low concentration is required of the approach of the aforementioned ** or ** in case chromatography separation of the component is carried out with ion-exchange resin at a dextrin fraction and an oligosaccharide fraction,

and cannot be separated since the sharpness of separation is not high in case it is chromatography separation entered into the oligosaccharide fraction, and the technical problem that the recovery of a dextrin was low also had it.

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MEANS

[Means for Solving the Problem]

[0011] The result to which this invention person etc. studied the manufacture approach of a dextrin wholeheartedly in order to solve said technical problem, After adjusting, heating and neutralizing to pH 9.5-12.4, by adding a calcium hydroxide to the slurry of amylum maydis, and going via an enzyme liquefaction process by the remarkable short simple approach It succeeds in preparing the dextrin equipped with the property suitable for a food-stuff-industry application which was excellent in versatility, and came to complete this invention.

[0012] The first this invention is faced manufacturing a dextrin, adds water to amylum maydis, makes it the slurry of 5 - 30 % of the weight of solid content concentration, adds a calcium hydroxide, adjusts it to pH 9.5-12.4, mixing to homogeneity, is heated at the temperature of 95-150 degrees C, and after neutralizing, it is the manufacture approach of the dextrin characterized by going via an enzyme liquefaction process.

[0013] The second this invention is the manufacture approach of a dextrin given in said first invention which heats for 5 - 60 minutes and carries out an enzyme liquefaction process to DE (dextrose equivalent) 1.5-15 by within the limits with a temperature of 90-105 degrees C using the heat-resistant hankyu liquifase of one to 20 unit per 1g of substrate solid content.

[0014] Face the third this invention manufacturing a dextrin, it adds water to amylum maydis, and makes it the slurry of 5 - 25 % of the weight of solid content concentration. Mixing to homogeneity, add a calcium hydroxide and it adjusts to pH 10-12. After adding heat-resistant hankyu liquifase, liquefying to DE 2-10 at the temperature of 90-98 degrees C, after heating for 5 - 60 minutes and neutralizing at the temperature of 105-135 degrees C, and carrying out deactivation of the enzyme by four or less pH, it is the manufacture approach of the dextrin characterized by going via a decolorization process, a deionization process, and a concentration process.

[0015]

[Embodiment of the Invention]

[0016] The contents of this invention are explained below at a detail.

[0017] The quality of the amylum maydis of extent which can adopt it advantageously if the starch used for this invention is starch of the corn origin, and constraint does not have in the manufacture approach of the place of production of raw material corn or starch, is marketed as corn starch, and is used as a common raw material for starch sugar manufacture is enough.

[0018] Since a dextrin and other components may not dissociate clearly in liquid but separation may become difficult in the case of a filtration process after adding the calcium hydroxide in this invention and heat-treating pH by 9.5-12.4 when this invention is applied to starch of the tapioca origin other than corn (for example, a potato), use of the starch of these origins should be avoided.

[0019] Although it considers as the slurry-like mixture which adds water to amylum maydis and is called starch milk in case this invention is carried out, the solid content content in that case has 5 - 30 desirable % of the weight, and 5 - 25% of the weight of its range is still more desirable.

[0020] Although it is possible to perform the reaction of this invention when solid content concentration

is less than 5% Are not desirable from the economical reasons of concentration costs increasing at that the throughput per scale of a facility becomes small, or a next process. When exceeding 30%, it is not desirable too from the reasons of actuation of heating, churning when viscosity becomes very high during churning, unevenness is made to a reaction or this invention is carried out for it, migration, filtration, etc. becoming very difficult.

[0021] Although the calcium hydroxide used for this invention is marketed as a food additive, if it has quality, it is enough, and there is no constraint in the gestalt and it can adopt advantageously all of the shape of the shape of a liquid and a slurry, and powder as it.

[0022] Next, the approach using a jet cooker which mixes the live steam and this slurry which are generally used as an approach of mixing to homogeneity this slurry obtained above in the case of starch liquefaction in an instant, and is made to pile up within a reaction etc. can adopt advantageously, and any of a batch process and continuous system are sufficient also as the method.

[0023] Although one of the big descriptions of this invention is to adjust within the limits of 10-12 still more preferably, and heat [9.5-12.4, and] within the limits of 105-130 degrees C still more preferably the temperature of 95-150 degrees C, pH of this starch slurry Since the effectiveness of this invention which is mentioned later, without a reaction fully advancing may not fully be acquired and a calcium hydroxide is preferably used by this invention on the other hand when pH in this case is less than 9.5 When pH exceeds 12.4, it is not desirable from the reasons of other pH regulators' being required and side reaction occurring.

[0024] Moreover, although whenever [stoving temperature] has desirable 95-150 degrees C when acquiring the good effectiveness of this invention, and 105-130 degrees C is still more desirable, when a reaction does not fully advance in the case of less than 95 degrees C but it exceeds 150 degrees C, bad debt and side reaction may occur.

[0025] Although the acid used in case a starch sugar ghost is generally prepared can adopt advantageously the neutralizer in the case of neutralizing after heating in this invention, since it is advantageous to carry out precipitate removal of the calcium used previously when the process after neutralization is taken into consideration, an acid which combines with calcium and generates precipitate, for example, oxalic acid, a sulfuric acid, phosphoric acid, etc. are the most advantageous.

[0026] although it is desirable to make it advantageous pH range in the case of next enzyme liquefaction as a standard of pH when neutralizing -- the range 6.0-6.9 where alpha-amylase is stable as desirable pH and where activity is high, i.e., pH, -- the range of pH 6.5-6.8 is raised still more preferably.

[0027] Next, although the various alpha-amylases adopted in the case of a general starch liquefaction process can adopt advantageously the hankyu liquifase used in this case although it is making to go via an enzyme liquefaction process into indispensable requirements in this invention, especially the heat-resistant hankyu liquifase that can be used at temperature high also in them is advantageous, and Termamyl (trademark) for example, by the Novo industry company etc. is mentioned as a class of brand.

[0028] Although the additions of an enzyme are employable as arbitration if they are the need and sufficient amount when realizing this invention, from the range of experience of an artificer, one to 20 international-unit (IU) extent is about suitable per 1g of starch solid content.

[0029] although the range where hankyu liquifase can demonstrate enzyme activity to advantageous extent economically should be adopted, in case heat-resistant hankyu liquifase is used for the temperature of an enzyme reaction still more preferably, it is still more suitable 80-108 degrees C as a desirable temperature requirement -- 90-105-degree C 90-98 degrees C are mentioned most preferably.

[0030] when [moreover,] acquiring the effectiveness of this invention -- an enzyme liquefaction reaction -- DE 1.5-15, although carried out to the range of 2-10 still more preferably In the case of less than 1.5 DE, it is very difficult to make desired DE suspend a reaction itself. and since the viscosity of the enzyme liquefaction liquid obtained is high, when it is common for handling to be difficult and it exceeds DE15 Since the property which is not desired as dextrans, like that the amounts of generation, such as a maltose and a glucose, increase and sweet taste becomes strong and viscosity becomes low too much becomes strong, it is not desirable.

[0031] Although the actuation to which deactivation of the enzyme is carried out is required after the enzyme liquefaction reaction of this invention Although each of approaches of the approach generally used in the starch sugar-ized industry being able to adopt the approach advantageously, for example, adding acids, such as a hydrochloric acid, a sulfuric acid, phosphoric acid, and oxalic acid, and lowering pH, approaches of heating and carrying out deactivation to about 110 degrees C, etc. can adopt When obtaining the product of fixed quality also in these, the method of adding an acid is the most desirable.

[0032] although it goes via a decolorization process in the desirable embodiment of this invention -- general saccharification of grape sugar, a starch syrup, etc. -- it is most desirable to be able to apply advantageously, also in case the approach adopted as elegance is this invention, and to decolorize by the approach of a batch process or continuous system using granular active carbon or powder-like activated carbon.

[0033] Although it is necessary to insert a filtration process after decolorization to adopt powder-like activated carbon, in the case of this invention, compared with the manufacture approach of the conventional dextrin, operation of a filtration process is very easy, and this is remarkable effectiveness acquired by carrying out this invention.

[0034] moreover, the usual saccharification in case a filtration process is carried out -- suitable filter aid, such as diatomaceous earth used at the time of manufacture of elegance, may be used, precoat can be carried out to filter-medium front faces, such as a filter cloth, it can mix on them with activated carbon, or performing above both can also be advantageously adopted as them.

[0035] furthermore -- although it goes via a deionization process in the desirable embodiment of this invention -- saccharification general also in this case -- approaches, such as the ion-exchange material and batch processes which are adopted as manufacture of elegance, such as a zeolite and resin for deionization, and continuous system, can adopt in favor also of this invention.

[0036] if an example of the combination of the resin adopted in the case of a deionization process is given -- the order of the monobed of strongly acidic cation exchange resin, strongly basic anion exchange resin, weakly acidic cation exchange resin, the Nakashio machine nature anion exchange resin, strongly acidic cation exchange resin, and strongly basic anion exchange resin -- ion exchange resin -- it is also an advantageous deionization method to let a column pass.

[0037] Since the mucus film is not formed in the front face of that the viscosity of liquid is remarkably low, or deionization material in the case of this invention and the life of deionization material is not shortened compared with the manufacture approach of the conventional dextrin in the case of this deionization process, operation is very easy and it is the remarkable effectiveness acquired when this also carries out this invention.

[0038] Although the dextrin water solution refined at the aforementioned decolorization and a deionization process goes via a concentration process in the desirable embodiment of this invention If it is a suitable approach in case matter with comparatively high viscosity, such as a thin film flowing-down type which is generally adopted as manufacture of a starch sugar-ized product about the approach, for example, is condensed, are employable. Although what is necessary is just to condense to extent which the suitable concentration in the case of making it circulate as a liquefied product changed with DE of a product, and met the request of a consumer, it is convenient when it is going to obtain a powder article, and it is made about 30 - 65% of concentration.

[0039] Moreover, after condensing, it is also free to prepare powder or granulation by the well-known approach in itself [, such as a spray drying method] if needed.

[0040] By carrying out this invention explained above, rather than the conventional approach, it becomes possible to perform processes, such as filtration and deionization, very easily, and the dextrin which has the outstanding property can be obtained.

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EXAMPLE

[Example]

[0042] Although an example is hung up over below and the contents of this invention are explained to it still more concretely, the technical range of this invention is not restricted by the following examples.

[0043] In addition, among each example, especially % shall express weight % altogether, unless it refuses.

[0044]

[Example -1]

[0045] Starch [Japan Maize Products Co., Ltd. make and corn-starch] 150g of marketing was put in into the proof-pressure liquefaction testing device with an agitator with a volume of 10l., and the calcium hydroxide of a reagent was added, it was referred to as pH10.5, agitating, after adding 850g of water and mixing, live steam was blown, and it heated for 15 minutes at the temperature of 125 degrees C.

[0046] Next, releasing and agitating the lid of a proof-pressure container, add oxalic acid and it is referred to as pH6.5. Adjusting in temperature of 95 degrees C Commercial heat-resistant hankyu liquifase [Novo industry company make, Add Termamyl (trademark)]750IU and it liquefies to DE5.

Oxalic acid is added, deactivation of the enzyme was carried out, 1g of commercial powdered activated carbon was added, churning decolorization was carried out for 20 minutes at the temperature of 50 degrees C, diatomaceous earth filter aid [Showa chemistry incorporated company make and trade name radio light (trademark)] 1g of marketing was further added and filtered until it was set to pH3.9, and the filtrate was obtained.

[0047] Furthermore, deionization of this filtrate was carried out with ion exchange resin, it condensed to 30% of concentration with rotating type thin film type concentration equipment (the Tokyo Rikakikai Co., Ltd. make, a rotary evaporator, N-1 N type), and 480g of clear dextrin water solutions was obtained by colorlessness. (The yield of solid content is 96% when the starch of a raw material is set to 100.)

[0048] The property of the dextrin water solution obtained in the example -1 is explained below.

[0049] As a result of measuring at [viscosity (concentration)] temperature of 40 degrees C, the viscosity of the dextrin water solution obtained in the example -1 was 40cp by 6cp and 30% at 4cp and 20% in 10% of concentration at 12cp and 40%.

[0050] It was light orange as a result of presenting an iodine starch reaction with the dextrin water solution obtained in the [iodine reaction] example -1. This result shows that most components of large molecular weight do not remain by actuation of this invention.

[0051] As a result of storing the dextrin water solution of 30% of concentration obtained in the [trial of aging] example -1 at the temperature of 4 degrees C and measuring the permeability of the light of this water solution, it was 99.2%, and as a result of measuring till the 30th every 5th day, light transmittance did not fall but was 99.2%. This result shows having the outstanding property in which the dextrin obtained by this invention cannot age very easily during a retention period.

[0052] [Sugar composition (G shows a grape-sugar unit)] For G2, G3 was [G1 / four or more / 8.1% G] 86.9% 4.5% 0.5%.

[0053]

[Example -2]

[0054] Set the amount of 70g and water to 930g for the amount of starch, set pH after adding a calcium hydroxide to 10.9, and it considered as for 20 minutes at the temperature of 110 degrees C, and also heated like the example -1.

[0055] Next, neutralized like the example -1, set the amount of enzymes to 10IU per 1g of starch, and it considered as the temperature of 94 degrees C, and also enzyme liquefaction was carried out to DE=3 like the example -1, enzyme deactivation, decolorization, deionization, and concentration were performed, and the dextrin water solution was obtained.

[0056] In actuation, the filtration after decolorization is easy, actuation is easy also in the case of deionization, and there was no difficulty on actuation in any way.

[0057]

[Example -3]

[0058] Set the amount of 200g and water to 800g for the amount of starch, set pH after adding a calcium hydroxide to 10.8, and it considered as for 20 minutes at the temperature of 130 degrees C, and also heated like the example -1.

[0059] Next, neutralized like the example -1, set the amount of enzymes to 15IU per 1g of starch, and it considered as the temperature of 95 degrees C, and also enzyme liquefaction was carried out to DE=11 like the example -1, enzyme deactivation, decolorization, deionization, and concentration were performed, and the dextrin water solution was obtained.

[0060] saccharification usual in a filtration process in process and a deionization process -- it is possible to operate it like processing of elegance, and there was no difficulty on actuation by the high viscosity and the high mucilage like [at the time of the usual dextrin manufacture].

[0061] The property of the dextrin water solution obtained in the example -3 is explained below.

[0062] As a result of measuring at [viscosity (concentration)] temperature of 40 degrees C, the viscosity of the dextrin water solution obtained in the example -3 was 30cp by 5cp and 30% at 3.5cp and 20% in 10% of concentration at 10cp and 40%.

[0063] It was light orange as a result of presenting an iodine starch reaction with the dextrin water solution obtained in the [iodine reaction] example -3. This result shows that most components of large molecular weight do not remain by actuation of this invention.

[0064] As a result of storing the dextrin water solution of 30% of concentration obtained in the [trial of aging] example -3 at the temperature of 4 degrees C and measuring the permeability of the light of this water solution, it was 99.1%, and as a result of measuring till the 30th every 5th day, light transmittance did not fall but was 99.0%. This result shows having the outstanding property in which the dextrin obtained by this invention cannot age very easily during a retention period.

[0065] [Sugar composition (G shows a grape-sugar unit)] For G2, G3 was [G1 / four or more / 10.3% G] 79.9% 8.3% 1.5%.

[0066]

[Example -4]

[0067] Set pH after adding a calcium hydroxide to 10.3, and it considered as for 20 minutes at the temperature of 130 degrees C, and also [all] the dextrin water solution was obtained like the example -1.

[0068] saccharification usual in a filtration process in process and a deionization process -- it is possible to operate it like processing of elegance, and there was no difficulty on actuation by the high viscosity and the high mucilage like [at the time of the usual dextrin manufacture].

[0069] The obtained dextrin water solution was further condensed under reduced pressure, and as a result of drying, the white powder-like dextrin was obtained.

[0070] the time of the obtained powder having not almost had sweet taste and there having been no starch smell, and it being easily dissolvable in cold water, and dissolving in it -- colorlessness -- it became a clear water solution.

[0071]

[The example -1 of a comparison]

[0072] Heat-treatment when the amount of 320g and water was set to 680g and also a calcium hydroxide is added and heated like an example -1, while it cannot mix since viscosity is very high and agitator was not able to do the amount of starch.

[0073]

[The example -2 of a comparison]

[0074] After having set pH after adding a calcium hydroxide to 8.5, and also heat-treating like the example -1 and neutralizing, when enzyme liquefaction was carried out like the example -1, deactivation of the enzyme was carried out and the decolorization process was performed, the filter mucilage adhered and it was not able to filter.

[0075]

[The example -3 of a comparison]

[0076] After having made whenever [stoving temperature / after adding a calcium hydroxide] into 90 degrees C, and also heat-treating like the example -1 and neutralizing, when enzyme liquefaction was carried out like the example -1, deactivation of the enzyme was carried out and the decolorization process was performed, the filter mucilage adhered and it was not able to filter.

[0077]

[The example -4 of a comparison]

[0078] Mix commercial starch [Japan Maize Products Co., Ltd. make and corn-starch] 150g and 850 commercialg of water, and it considers as 15% of solid content concentration. Per 1g of substrates, after adjusting to pH6.2 The heat-resistant hankyu liquifase [Novo industry company make of 10IU, After having heated for about 3 minutes at the temperature of 105 degrees C, then having cooled liquid at 65 degrees C using Termamyl (trademark)], adding this heat-resistant hankyu liquifase 10IU further and holding for 30 minutes, oxalic acid was added, it was referred to as pH3.8, and the dextrin of DE15 was obtained.

[0079] As a result of storing the dextrin water solution of 30% of concentration obtained in the example -4 of a comparison at the temperature of 4 degrees C and measuring the permeability of the light of this water solution, although it was immediately after manufacture about 98.4%, white muddiness already occurred at the 1st day, as a result of measuring till the 30th every 5th day, with time amount, light transmittance continued falling and permeability became about 15% on the 25th.

[0080]

[Translation done.]